

What is Claimed is:

- 1 1. A process for the production of NF₃ comprising:
 - 2 a) reacting fluorine gas at an initial concentration and liquid
 - 3 ammonium acid fluoride in a first reaction zone in a relatively low energy
 - 4 environment to produce a first reaction product including NF₃ and at least some
 - 5 unreacted fluorine gas; and
 - 6 b) reacting the first reaction product including the unreacted
 - 7 fluorine gas in a second reaction zone in a relatively high energy environment to
 - 8 produce a second reaction product, wherein the low energy environment in the first
 - 9 reaction zone and the high energy environment in the second reaction zone
 - 10 substantially convert the fluorine gas to NF₃ in a manner which at least substantially
 - 11 reduces corrosion in the first and second reaction zones due to the corrosive
 - 12 properties of the fluorine gas.
- 1 2. The process of claim 1 wherein the first reaction zone has a first power
- 2 input and a first aspect ratio and the second reaction zone has a second power input
- 3 higher than the first power input and a second aspect ratio lower than the first aspect
- 4 ratio.
- 1 3. The process of claim 1 further comprising separating the NF₃ from the
- 2 second reaction product.

1 4. The process of claim 2 wherein the first aspect ratio is from about 5 to
2 150.

1 5. The process of claim 4 wherein the first aspect ratio is from about 10 to
2 100.

1 6. The process of claim 2 wherein the first power input in the reaction
2 zone is less than about 1,000 watts per cubic meter of NH₄F(HF)_x.

1 7. The process of claim 6 wherein the first power input in the first reaction
2 zone is less than about 500 watts per cubic meter of NH₄F(HF)_x.

1 8. The process of claim 2 wherein the second aspect ratio is up to about
2 5.

1 9. The process of claim 8 wherein the second aspect ratio is about 1.

1 10. The process of claim 2 wherein the second power input in the second
2 reaction zone is at least 5,000 watts per cubic meter of NH₄F(HF)_x.

1 11. The process of claim 1 wherein the reaction of fluorine gas in the first
2 reaction zone converts at least 35% of the fluorine gas to the first reaction product.

1 12. The process of claim 11 wherein the reaction of fluorine gas in the first
2 reaction zone converts at least 45% of the fluorine gas to the first reaction product.

1 13. The process of claim 12 wherein the reaction of fluorine gas in the first
2 reaction zone converts at least 65% of the fluorine gas to the first reaction product.

1 14. The process of claim 1 wherein the first power input in the first reaction
2 zone is in part obtained from the introduction of the fluorine gas to the first reaction
3 zone.

1 15. The process of claim 1 comprising conducting the reaction in the first
2 and second reaction zones at a temperature of from about 110 to 150°C.

1 16. The process of claim 15 comprising conducting the reaction in the first
2 and second reaction zones at a temperature of from about 120 to 140°C.

1 17. The process of claim 1 wherein the liquid $\text{NH}_4\text{F}(\text{HF})_x$ melt acidity x
2 value is from about 1.2-2.2.

1 18. The process of claim 17 wherein the melt acidity x value is from about
2 1.4-2.0.

1 19. The process of claim 18 wherein the melt acidity x value is from about
2 1.6-1.8.

1 20. The process of claim 1 wherein the first reaction product contains an
2 impurity gas comprising N₂F₄, said process further comprising reacting the impurity
3 gas with fluorine gas at an elevated temperature to convert at least some of the
4 impurity gas to NF₃.

1 21. The process of claim 20 wherein the impurity gas comprises N₂F₄ and
2 N₂F₂.

1 22. The process of claim 20 comprising reacting the impurity gas with
2 fluorine gas at a temperature of 200 to 400°C.

1 23. The process of claim 1 wherein the first reaction zone includes a static
2 mixing element.

1 24. The process of claim 1 wherein the second reaction zone includes a
2 dynamic mixing assembly.

1 25. Apparatus for the production of NF₃ comprising:
2 a) a first reaction zone for reacting fluorine gas at an initial
3 concentration and liquid ammonium acid fluoride;

4 b) means for providing a low energy environment to the first reaction zone
5 to produce a first reaction product including NF₃ and at least some unreacted fluorine
6 gas;
7 c) a second reaction zone for receiving the first reaction product and for
8 reacting the unreacted fluorine gas therein; and
9 d) means for providing a high energy environment to the second reaction
10 zone to convert the fluorine gas to NF₃ in a manner which substantially reduces
11 corrosion in the first and second reaction zones due to the corrosive properties of the
12 fluorine gas.